



Technical Report

## VVols on NetApp Clustered Data ONTAP Beta Test Deployment

Peter Learmonth, NetApp  
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**EARLY ACCESS DRAFT – SUBJECT TO CHANGE – BETA CONTENT**

BETA-DRAFT - Subject to change

### Abstract

This document is meant to get VVols on NetApp beta testers started with VVols. All content is subject to NDA between authorized testers and VMware and NetApp under separate nondisclosure agreements (NDA). Assumptions are made that the tester has familiarity with VMware vSphere concepts and deployment. This information subject to change.

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# 1 Solution Overview

These instructions assume a working knowledge of a previous version of VMware vSphere, including deploying OVF/OVA appliances, creating VMs, mounting ISO images as a CD/DVD for a VM and similar tasks. Some detailed steps are omitted, but steps that vary from normal procedures are explicit.

## 1.1 VVols concepts

VVols and the related components provide the building blocks for VM granular management. The fundamental goal is to separate the management of storage from the management of VMs, and the required knowledge and understanding for the two technology areas. Currently, the administrators who understand storage have to explain to the non-storage VM administrators how to identify which datastores to use for what kind or class of VM or its component virtual disks and other component objects that consume storage. They may achieve that currently through some combination of documentation or datastore naming convention. However, consistency, compliance, and verification are difficult to achieve.

VM Storage Policies provide one of the building blocks for this solution. While they exist in previous versions of vSphere, the sophistication was not there to query the actual storage for its capabilities to include in rule sets. Capabilities could only be advertised as a single string. VMware APIs for Storage Awareness (VASA) 2.0 provides the technology to query storage and return a set of capabilities. The VASA Vendor Provider (VP) provides the translation between the storage system's APIs and constructs and VASA APIs that vCenter understands.

In the NetApp implementation, the VP is an appliance VM deployed to vCenter from an OVA (Open Virtual Appliance) file. Management is usually performed using additional pages and context-sensitive menus that are part of the Virtual Storage Console plugin.

The vendor provider presents a set of capabilities of a storage array or object within the array. The capabilities may include features such as availability, performance, capacity, space efficiency, replication or protocol. Support for a capability may require specific hardware, license(s) or configuration.

Table 1) NetApp supported capabilities

Capability	VM Stg Policy Values	SCP Values	Requirements and Notes
Profile Name	Selection from list	N/A	Used in VM Storage Policies to map a NetApp SCP, allowing the vSphere administrator to select a predefined set of capabilities.
Autogrow	Yes, No	Yes, No, Any	Volume set to allow autogrow
Compression	Yes, No	Yes, No, Any	Compression enabled on volume
Deduplication	Yes, No	Yes, No, Any	Deduplication enabled on volume
DiskTypes	Multi-select: SATA, FCAL, SAS, SSD	SATA, FCAL, SAS, SSD, Any	Aggr must consist of disks of the specified type
Flash Accelerated	Yes, No	Yes, No, Any	FlashCache cards installed in node hosting the containing aggr, OR FlashPool aggr containing SSD and another disk type, and aggregate

Capability	VM Stg Policy Values	SCP Values	Requirements and Notes
			setting is-hybrid=true
High Availability	Yes, No	HA Pair, No HA, Any	Nodes configured as HA Pairs
MaxThroughput_IOPS	Numeric	Number then select IOPS or MBPS	QOS on the FlexVol with IOPS limit
MaxThroughput_MBPS	Numeric	Number then select IOPS or MBPS	QOS on the FlexVol with throughput limit
Protocol	Multi-select: NFS, iSCSI, FCP	NFS, iSCSI, FCP, Any	Matching protocol licensed and properly configured in the SVM including necessary data LIFs
Replication	Yes, No	Async, Sync, None, Any	SnapMirror relationship replicating the FlexVol to another FlexVol. Replication relationships are created and managed outside of vCenter and VSC, for example, using NetApp System Manager.

A set of capabilities for a volume or set of volumes is called a Storage Capability Profile (SCP). SCPs are created and managed using VSC. The VP surfaces SCPs to vCenter, as well as individual capabilities.

VMs that use VVols are created using VM Storage Policies. VM Storage Policies must be created by the vSphere admin to map NetApp capabilities to one or more VM Storage Policies. Capabilities can be mapped into VM Storage Policies either as an SCP or as individual capabilities or both. If both are used, the individual capability selected in the VM Storage Policy will override the capability selection in the SCP. For example, if a VM storage policy includes both an SCP that requires deduplication, and the separate deduplication capability with the setting of “no”, the resulting policy requires a FlexVol without deduplication. The create VM Storage Policy wizard lists compatible and incompatible storage after selecting capabilities and/or a profile.

The other big aspect of the VM granular management architecture is the change in storage objects. Traditional datastores are either VMFS file systems created on LUNs or storage controller file systems presented as NFS mounts. Within these datastores, a VM has a directory with a set of files. The virtual disks are large files containing a disk image. There are also VM swap files, configuration files, logs and others.

In the NetApp implementation of VVols, a VVol datastore consists of one or more FlexVol volumes within a storage container (also called “Backing Storage”). A storage container is simply a set of FlexVol volumes used for VVol datastores. All the FlexVols within a storage container must be accessed using the same protocol (NFS, iSCSI, or FCP) and be owned by the same Storage Virtual Machine (SVM, formerly called Vserver), but they can be hosted on different aggregates and nodes of the NetApp cluster.

FlexVols can be created outside of the VSC workflows or as part of the new VVol datastore wizard. However, all LUN and other VVol-related objects are created and managed by the VP.

A VVol is either a LUN when used with block protocols or a file or directory with NFS. A VVol LUN is not mapped (masked in common SAN terminology) to storage in the sense of traditional LUNs.

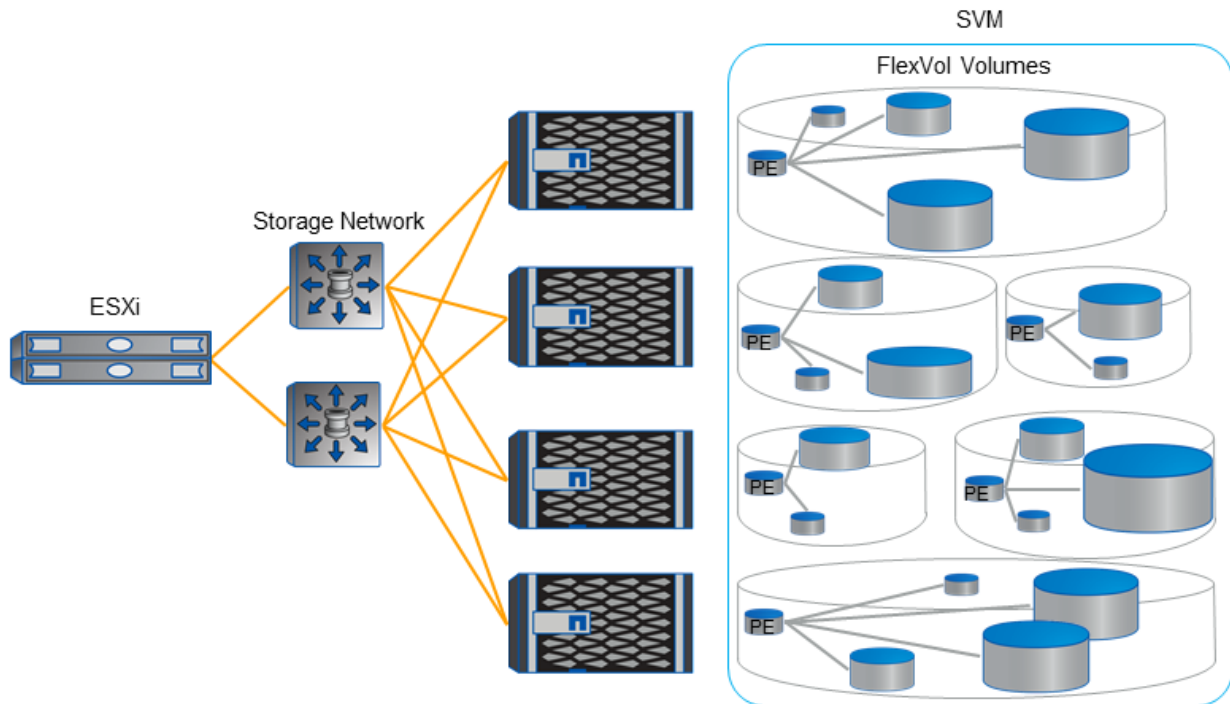
**Table 2) VVol types and implementation**

VVol Type	Block Implementation	NFS Implementation	Notes or example
Config	LUN, 4GB	Directory containing config files and pointers to other VVols	VMX, NVRAM, logs, VMDK descriptors, snapshot descriptors. One per VM. Contains small VMFS.
Data	LUN, size of virtual disk	File, size of virtual disk	
Swap	LUN, size of virtual memory*	File, size of virtual memory*	Created when VM is powered on; deleted when VM is powered off.
Memory	LUN, size of virtual memory	File, size of virtual memory	Only created if memory snapshot is selected during running VM snapshot.
Other	Depends on use case	Depends on use case	VMware HA datastore heartbeat information (4GB LUN or NFS directory)

\*Technically, Swap is the size of VM memory minus any VM memory reservation.

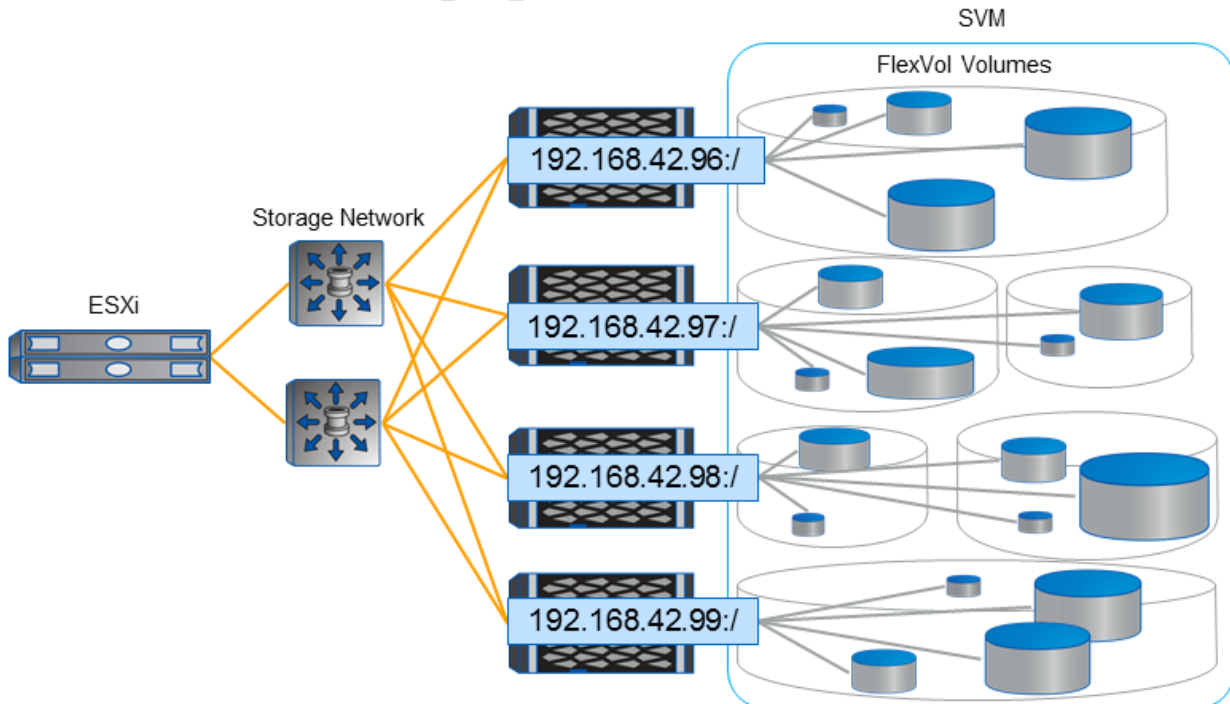
The IO path to a VVol is through a Protocol Endpoint (PE). For block protocols, a PE is a small (4MB) LUN, and the VP creates one PE in each FlexVol that is part of a VVol datastore. PEs are mapped to initiator groups created and managed by the VP.

Figure 1) LUN protocol endpoints



For NFS, a PE is a mount point to the root of the SVM. A PE is created by the VP for each data LIF of the SVM using the LIF's IP address. PE's are created when the first VVol datastore is created on the SVM using the specific protocol. The VP automatically creates export policy rules.

Figure 2) NFS Protocol Endpoints



I/O to a VVol is through a specific PE. VVol LUNs are bound to the PE through a binding call managed by the VP. The VP determines which PE is on the same node as the FlexVol containing the VVol and binds the VVol to that PE. VVols are bound to a PE on access from an ESXi server. The most common form of access is powering on the VM. The following command shows the binding relationship between a VVol and the PE LUN through which ESXi accesses the VVol.

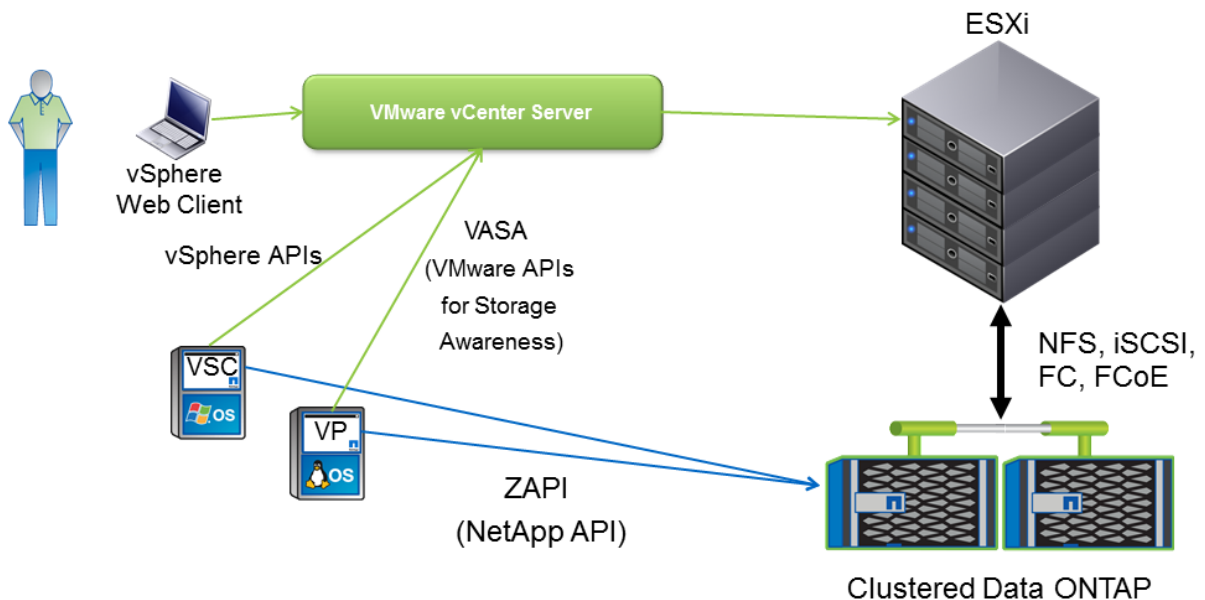
```
eadrax::*> lun bind show -instance
Vserver: xaxis
PE MSID: 2147484885
PE Vdisk ID: 800004d50000000000000000000000063036ed591
VVol MSID: 2147484951
VVol Vdisk ID: 8000051700000000000000000000000601849f224
Protocol Endpoint: /vol/ds3/vvolPE-1410312812730
PE UUID: d75eb255-2d20-4026-81e8-39e4ace3cbdb
PE Node: eadrax-03
VVol: /vol/vvol31/naa.600a098044314f6c332443726e6e4534.vmdk
VVol Node: eadrax-03
VVol UUID: 22a5d22a-a2bd-4239-a447-cb506936ccd0
Secondary LUN: d2378d000000
Optimal binding: true
Reference Count: 2
```

## 1.2 Solution Technology

The core enabling component for VVols is the VASA vendor provider. It communicates with vCenter using VASA APIs and with NetApp clustered Data ONTAP using NetApp APIs called ZAPIs.

Figure 3 shows the technical components of the solution.

Figure 3) vCenter, VSC, VASA VP, ESXi servers and clustered Data ONTAP.



**Note:** While all components of the VVols beta can be virtualized, NetApp recommends that any of the components in Figure 3 that are virtualized run on a separate, stable vSphere infrastructure, not on the ESXi 6.0 beta servers.



The VP is deployed as an OVA virtual appliance and is managed by Virtual Storage Console plugged in to the vSphere Web Client. The administrator manages VASA and VVols using the Web Client.

VMs running on VVols require that the VP is running in order to power on VMs because the swap VVol is created when the VM is powered on. This also means that the VP itself should not be running on VVols since it would be its own dependency.

### 1.3 Use Case Summary

This solution applies to the following uses cases:

- Deploying VVols with NetApp clustered Data ONTAP on NFS
- Deploying VVols with NetApp clustered Data ONTAP on iSCSI
- Deploying VVols with NetApp clustered Data ONTAP on FC

### 1.4 Limitations

Per VMware, VVols do not support NFS v4.

The X2 release candidate build of VP and VSC does not support ESXi servers that are members of vSphere distributed switches (vDS), even if the vDS is not used for storage traffic. Such hosts will display as incompatible or in maintenance mode.

## 2 Initial Setup

This section describes tasks common to the VVols on NetApp solution that are common to all storage protocols.

### 2.1 Technology Requirements

This section covers the technology requirements for testing VVols on Clustered Data ONTAP.

#### Hardware Requirements

Table 3 lists the hardware components required to implement the use case.

Table 3) Testing VVols on Clustered Data ONTAP hardware requirements.

Hardware	Quantity
Servers that support vSphere 6.0 beta	1 minimum, 2 preferred
NetApp cluster that supports clustered Data ONTAP 8.2.1 or higher OR NetApp Vsim running clustered Data ONTAP 8.2.1 or higher	1 cluster, with 1 node minimum
Networking hardware (switches, HBAs/NICs, etc.) to support selected protocol(s)	

#### Software Requirements

Table 4 lists the software components required to test Vvols on NetApp Clustered Data ONTAP. Note that these instructions may apply to later versions, but some steps will change. For example, some manual steps may become part of a wizard or workflow.

**Table 4) Testing VVols on Clustered Data ONTAP software requirements.**

Software	Version or Other Information
clustered Data ONTAP	8.2.1 or higher
VMware vSphere 6.0 beta 2	6.0 Release Candidate consisting of ESXi build 2159203 vCenter Server Appliance build 2175370 OR vCenter Server build 2172336 vSphere Beta and RC downloads can be accessed by clicking “Join Now” at <a href="https://communities.vmware.com/community/vmtn/vsphere-beta">https://communities.vmware.com/community/vmtn/vsphere-beta</a> or if you have already joined the beta, at <a href="https://communities.vmware.com/community/vmtn/beta/vsphere-beta">https://communities.vmware.com/community/vmtn/beta/vsphere-beta</a> .
NetApp Virtual Storage Console	5.0.1X7 <a href="http://mysupport.netapp.com/NOW/download/software/beta/beta_vasa_cdot/6.0X2/">http://mysupport.netapp.com/NOW/download/software/beta/beta_vasa_cdot/6.0X2/</a>
VASA Provider 6.0 for clustered Data ONTAP	6.0X2 <a href="http://mysupport.netapp.com/NOW/download/software/beta/beta_vasa_cdot/6.0X2/">http://mysupport.netapp.com/NOW/download/software/beta/beta_vasa_cdot/6.0X2/</a>
Windows Server 2008 or 2012	VSC runs on this VM or server

## 2.2 Deployment Procedures

Deploying the solution involves the following tasks:

- Configure and test DNS entries for vCSA, VASA VP, VSC Windows Server
- Deploy cDOT (hardware or Vsim)
- Create and configure a SVM for VVol use
- Deploy server(s) and install ESXi 6.0 beta2
- Deploy vCenter Server Appliance (vCSA) 6.0 beta2
- Deploy or clone Windows Server VM
- Install VSC in Windows Server VM
- Deploy NetApp VASA Vendor Provider

### Configure and test DNS entries for vCSA, VASA VP, VSC Windows Server

Specific steps for configuring DNS entries depend on your infrastructure, however, the following entities must have properly working DNS entries, and the hostnames used when deploying them must match DNS.

- vCenter Server 6.0 (vCSA or Windows based)
- NetApp VASA Vendor Provider appliance
- Windows Server running VSC

The following should have DNS entries, but if not, VVols may still work:

- ESXi servers
- cDOT cluster management and node management LIFs
- SVM (vserver) management LIFs

SVM data LIFs do not need DNS entries, especially if they are on a separate, private storage network.

Table 5 provides a suggested list of entities and their DNS and IP addresses. Not all are needed, depending on the number of nodes in your cDOT cluster and which protocols you are using. NFS and iSCSI require separate LIFs with their own IP addresses since cDOT allows NFS LIFs to move and failover, but not iSCSI LIFs.

**Table 5) Entity DNS and IP list**

Entity	DNS FQDN or hostname	IP
vCenter Server		
NetApp VASA VP		
VSC Server		
ESXi 1		
ESXi 2		
cDOT cluster mgmt		
cDOT node 1		
cDOT node 2		
cDOT node 3		
cDOT node 4		
SVM 1 mgmt		
SVM 1 NFS LIF 1 (homed on node 1)		
SVM 1 NFS LIF 2 (homed on node 2)		
SVM 1 NFS LIF 3 (homed on node 3)		
SVM 1 NFS LIF 4 (homed on node 4)		
SVM 1 iSCSI LIF 1 (homed on node 1)		
SVM 1 iSCSI LIF 2 (homed on node 2)		
SVM 1 iSCSI LIF 3 (homed on node 3)		
SVM 1 iSCSI LIF 4 (homed on node 4)		

node 4)		

## Testing DNS entries

1. On any Windows or Linux system or VM with network access to the lab, run the `nslookup` command.
2. Set the current DNS server to the DNS server supporting the lab.

```
> server 172.16.24.31
Default Server: [172.16.24.31]
Address: 172.16.24.31
```

3. Enter the hostname to be used for vCSA 6.0. The following console block shows an unsuccessful and a successful lookup:

```
> plvcsa60b2
Server: [172.16.24.31]
Address: 172.16.24.31

*** [172.16.24.31] can't find plvcsa60b2: Non-existent domain
> plvcsa60beta1
Server: [172.16.24.31]
Address: 172.16.24.31

Name: plvcsa60beta1.vgibu.eng.netapp.com
Address: 172.16.24.35
```

4. To check reverse lookup, enter the IP address to be used for vCSA 6.0.

```
> 172.16.24.35
Server: [172.16.24.31]
Address: 172.16.24.31

Name: plvcsa60beta1.vgibu.eng.netapp.com
Address: 172.16.24.35
```

5. Repeat these steps for the VASA VP, VSC server, and other entities.

## Time services

It is recommended to use a common time server for all servers (including the ESXi 6 test servers and the servers hosting vCSA, VSC and the VP), storage and VMs in the environment. Ensure each device or VM is configured to use the time server.

## Deploy cDOT on Physical Hardware

Specific steps for deploying cDOT on physical hardware are out of scope for this document and covered in the cDOT installation and setup guides at

<http://mysupport.netapp.com/documentation/docweb/index.html?productID=61868&language=en-US>.

## Deploy cDOT using a Vsim

<Vsim download details tbd. These instructions may change.>

To deploy cDOT using a Vsim, complete the following steps:

1. On your ESXi server, create a portgroup called "Cluster Network" on a vSwitch. For a single Vsim, the vSwitch can be isolated (have no uplinks).
2. Download from <tbd>

3. Extract files into a directory under a datastore. You don't need to rename any files or VMX entries, even if you want to rename the VM.
4. Browse the datastore and register the VM. You should rename the VM.
5. Edit VM settings and verify the virtual NICs are on the correct virtual networks (portgroups). The first two (which will become e0a and e0b) should be on "Cluster Network". The third (e0c) should be on a routable network such as "VM Network". The fourth (e0d) should be on your storage network, which may be physically separate or a VLAN, or in smaller labs could be the same network as one or all of the first three.
6. Power on the Vsim VM.
7. Open the VM console.
8. When you see the "Press Ctrl-c for Boot Menu" prompt, press ctrl-c.

```

*****
*                                     *
* Press Ctrl-C for Boot Menu.       *
*                                     *
*****
^CBoot Menu will be available.

Please choose one of the following:

(1) Normal Boot.
(2) Boot without /etc/rc.
(3) Change password.
(4) Clean configuration and initialize all disks.
(5) Maintenance mode boot.
(6) Update flash from backup config.
(7) Install new software first.
(8) Reboot node.
Selection (1-8)? █

```

**Note:** This used to say "Press ctrl-c for special boots". Since the prompt has changed, it is no longer required to wear special boots when accessing this menu. OK, seriously, if you miss the ctrl-c menu, the boot process will likely panic and come back to it after a minute anyway.

9. Enter 4 to select Option 4 which will assign 3 disks to the Vsim and zero them out. Answer y to the confirmation questions. The Vsim will reboot and zero the disks which takes a few minutes.
10. The Vsim boots into the cluster setup wizard.
11. If this is the first or only planned Vsim, enter create and press enter.
12. Enter yes for single node cluster.
13. Give the cluster a name.
14. Enter the cluster base license key.
15. Do not enter additional keys at this time. (Well, you can, but it's easier to copy and paste once you have SSH working.)
16. Enter a password for cluster admin (twice).
17. Cluster management should be on e0c.
18. Enter the IP address for cDOT cluster management from Table 5, and the netmask and default gateway.
19. Enter DNS domain(s) and DNS server(s) separated by commas.
20. Location is optional.

21. Node management interface port should be the same as cluster management (e0c).
22. Enter the IP address for node management from Table 5, and the netmask and default gateway.
23. Backup location is optional.
24. You can now log in via SSH to complete the rest. SSH to admin@<cluster\_mgmt\_ip>
25. Add additional licenses. Ensure you add at least one protocol license (NFS or iSCSI) and FlexClone.

```
cluster::> license add -license-code <code>
```

Protocol or Feature	License command and key
NFS	<td>
iSCSI	<td>
SnapMirror	<td>
FlexClone	<td>

## 26. Look at the available disks

```
plvsim2::> disk show
```

Disk	Usable Size	Shelf	Bay	Container Type	Position	Aggregate	Owner
plvsim2-01:0b.0	7.99GB	-	-	aggregate	dparity	aggr0	plvsim2-01
plvsim2-01:0b.1	7.99GB	-	-	aggregate	parity	aggr0	plvsim2-01
plvsim2-01:0b.2	-	-	-	unassigned	present	-	-
plvsim2-01:0b.3	7.99GB	-	-	aggregate	data	aggr0	plvsim2-01
plvsim2-01:0b.4	-	-	-	unassigned	present	-	-
plvsim2-01:0b.5	-	-	-	unassigned	present	-	-
plvsim2-01:0b.6	-	-	-	unassigned	present	-	-
plvsim2-01:0b.8	-	-	-	unassigned	present	-	-
plvsim2-01:0b.9	-	-	-	unassigned	present	-	-
plvsim2-01:0b.10	-	-	-	unassigned	present	-	-
plvsim2-01:0b.11	-	-	-	unassigned	present	-	-
plvsim2-01:0b.12	-	-	-	unassigned	present	-	-
plvsim2-01:0b.13	-	-	-	unassigned	present	-	-
plvsim2-01:0b.14	-	-	-	unassigned	present	-	-
plvsim2-01:0b.15	-	-	-	unassigned	present	-	-

15 entries were displayed.

## 27. Assign all disks to the Vsim:

```
plvsim2::> disk assign -all true -node <node>
```

## 28. Create a data aggregate using all spares except one

```
plvsim2::> aggr create -aggregate aggr1 -diskcount 11 -raidtype raid4
```

**Note:** RAID type raid4 should only be used with Vsims. Best practice for physical clusters is raid\_dp.

29. If you get a warning "Warning: Creation of aggregate "aggr1" has been initiated. 11 disks need to be zeroed before they can be added to the aggregate. The process has been initiated. Once zeroing completes on these disks, all disks will be added at once. Note that if the system reboots before the disk zeroing is complete, the aggregate will not exist." Wait for the disks to zero and the aggregate to come on line. Check status with aggr show.

```
plvsim2::> aggr show
Aggregate      Size Available Used% State  #Vols  Nodes      RAID Status
-----
aggr0          7.18GB   343.9MB   95% online    1 plvsim2-01  raid_dp,
normal
aggr1          64.59GB   64.59GB    0% online    0 plvsim2-01  raid_dp,
normal
2 entries were displayed.
```

## Create and configure a SVM for VVol use

### OnCommand System Manager

This procedure can be completed using wizards in OnCommand System Manager. Please see the OCSM documentation for instructions.

### CLI

1. The fastest way to create a SVM (Vserver) is using the vserversetup wizard.
2. From the CLI via SSH, enter `vserversetup`.
3. Give the SVM a meaningful name.
4. Enter the protocols you wish to use, separated by commas.
 

**Note:** Ensure you have previously entered the necessary licenses for each protocol you wish to use before creating a SVM with those protocols.
5. The remaining wizard Step 1 SVM questions are straightforward and for the most part you can accept the defaults. For vvol testing, you usually won't need any of the Vserver client services (ldap, nis, dns).
6. In wizard step 2 you can create a set of volumes to be used for vvol datastores. These steps are also straightforward. You need at least one volume. You can create multiple volumes and change settings on the volumes such as deduplication and compression in order to have different capabilities that can be exposed by the VP.
7. In wizard step 3 you can create logical interfaces for the protocols you have configured. You should create a LIF per node per fabric or network. Select the correct protocol for each LIF (fc, iscsi or nfs). For single-node Vsims, you should usually use e0d for data LIFS to connect to ESXi. You can leave the gateway blank if ESXi server storage network VMkernel ports and cDOT data LIFs are on the same subnet.
8. In wizard step 4 you configure protocols.
  - For NFS, no questions are asked.
  - For FCP and iSCSI, the wizard prompts you to create an initiator group and LUN, which are not necessary or used for vvol. At least one initiator is required for the igroup but you can enter the example "iqn.1995-08.com.example:string" for iSCSI or a fake WWPN such as "20:00:01:02:11:11:11:11" for FCP. Create the LUN very small (20m) since it won't be used. You can either delete these objects or ignore them. If you do not complete this part of the wizard, the FCP or iSCSI service will not be created, but you can create it by hand using the `iscsi create` or `fc create` command.
9. After the SVM is created, disable NDMP node scope and enable NDMP for the SVM.

```
cluster::> system services ndmp node-scope-mode off
NDMP node-scope-mode is disabled.

cluster::> vservers modify -vserver <svm> -allowed-protocols fcp,ndmp
cluster::> vservers services ndmp on -vserver <svm>
```

**Note:** Disabling NDMP node scope is a one-time task per cluster. Ensure you include other allowed protocols in the `vserver modify allowed protocols` list.

## 2.3 Protocol Setup

### NFS

To prepare for VVols over NFS, ensure you have a data LIF per node for the SVM supporting VVols. These data LIFs must be homed on a port on the ESXi to storage network. If you are using the Vsim in a single node configuration, this means one data LIF configured for NFS. iSCSI and NFS LIFs must be separate, but can coexist on the same network and physical port, ifgrp or VLAN.

If you did not create an NFS service on your SVM when you created the SVM, create an NFS service as follows:

1. Create the NFS service for your SVM

```
cluster::> nfs create -vserver <svm_name> -access true -v3 enabled -tcp enabled -vstorage enabled
```

2. Create volumes for VVols use

```
cluster::> vol create -vserver deleteme -volume vvol1 -aggregate n4a1 -size 1t -state online -  
type RW -policy default -junction-path /vvol1
```

You do not need to manage export policies as the VP will do this automatically.

### iSCSI

To prepare for VVols over iSCSI, ensure you have a data LIF per node for the SVM supporting VVols. These data LIFs must be homed on a port on the ESXi to storage network. If you are using the Vsim in a single node configuration, this means one data LIF configured for iSCSI. iSCSI and NFS LIFs must be separate, but can coexist on the same network and physical port, ifgrp or VLAN.

Create and configure ESXi iSCSI vmkernel ports on the same network, VLAN and subnet as the SVM target LIFs.

Create empty volumes, but do not create any LUNs or igroups.

### FC

Note that FC is not supported with Vsim as it is not possible to have hardware HBAs with a virtual storage appliance. To prepare for VVols over FC, ensure you have a data LIF per node per fabric for the SVM supporting VVols. For example, if you have 2 nodes and typical dual redundant SAN fabrics, you should have 4 FC target LIFs in the SVM each home on a different physical FC target port.

Remember all zoning rules and practices apply, and that you should use soft zoning specifying the target WWPN of the SVM LIFs, not the physical ports of the nodes.

Create empty volumes, but do not create any LUNs or igroups.

## 2.4 Install Server(s) and Install ESXi 6.0 RC

Installing physical server hardware is out of scope of this document. To install ESXi, follow the instructions in vSphere 6.0 (beta 2) vSphere Installation and Setup guide. There are no special configuration requirements for ESXi other than the appropriate networking and/or SAN.

Note that with the RC versions of VSC and VASA Vendor Provider, if the ESXi servers are members of a vSphere distributed switch (vDS), they will appear to be incompatible. This applies even if the vDS is not used for storage networking.



## 2.5 Deploy vCenter Server Appliance (vCSA) 6.0 RC

Previous versions of this document included instructions for installing vCSA as an OVF virtual appliance. VMware has completely changed the installation of vCSA, and now use vCenter Server Appliance Installer, distributed as an ISO image. Refer to the vSphere Installation and Setup guide for vSphere 6.0 (RC), chapter 9, available on the vSphere 6.0 RC documentation page. Note the following when installing vCSA:

- Ensure you connect the installer to an ESXi host, not a vCenter server, even if the host is registered to a vCenter instance.
- It is recommended to install vCenter on an ESXi host running a GA version of ESXi, not beta or RC.
- NetApp recommends using at least the “Embedded-Small (up to 150 hosts, 3000 VMs)” vCSA size for even small VVol environments
- There is no default SSO domain. This document uses vsphere.local, which was the previous beta default.
- Ensure the networking parameters match the settings in DNS

Once vCSA is installed and running, complete the following additional standard tasks.

- Log in to vCenter using the vSphere Web Client.
- Create virtual datacenter
- Create ESXi cluster (optional)
- Add ESXi servers
- Install and assign vCenter and ESXi beta licenses
- Verify and/or complete the configuration of ESXi servers such as driver installation and network configuration.

## 2.6 Deploy VSC and VASA Vendor Provider

### Create or clone a Windows Server VM for Virtual Storage Console

Exact steps will depend on your environment. This server can be physical or virtual but should be on existing infrastructure other than the ESXi servers being used for the beta. Ensure that Windows is legitimate and properly activated. Check firewall settings to allow VSC, VP, and vCenter traffic.

### Install and Configure Virtual Storage Console

For more information, please see the VSC 5.0 documentation at <http://mysupport.netapp.com/documentation/docweb/index.html?productID=61789&language=en-US>.

1. In the Windows server for VSC, download and run 5.0.1X7-win64.exe.

**Note:** Version of the file may change as new versions of VSC and VP are released to match new vSphere betas or RC.

2. Click Next, check “I understand ...”, then Next again.
3. Leave Backup and Recovery unchecked and click Next, Next, Install.
4. If you get a dialog stating that “The NetApp vSphere Plugin Framework has not yet started.”, complete the following on the VSC Windows server:
  - a. Open a command prompt
  - b. CD to the bin directory in the VSC installation directory, usually C:\Program Files\NetApp\Virtual Storage Console\bin.
  - c. Run the following command:

```
C:\Program Files\NetApp\Virtual Storage Console\bin> vsc.bat ssl setup -generate-passwords
```

- d. Start the Virtual Storage Console for VMware vSphere Server service (also known as NetApp vSphere Plugin Framework or NVPF) in Windows Services.
5. If it didn't happen automatically, open a browser to <https://localhost:8143/Register.html>.
6. In the plugin service information box, select either the FQDN or the IP address of the VSC server.
7. Fill in the vCenter Server information. Use "administrator@vsphere.local" for User name.

### vSphere Plugin Registration

To register the Virtual Storage Console, select the IP Address you would like to use for the plugin and provide the vCenter Server's IP address and port along with a valid user name and password.

Plugin service information

Host name or IP Address: 172.16.24.37

vCenter Server information

Host name or IP Address: 172.16.24.35

Port: 443

User name: administrator@vsphere.local

User password: ••••••••

Register

8. Click Register.
9. In your browser where you were logged in to vSphere 6.0 Web Client, log out and back in again.
10. Virtual Storage Console icons and menus should be available in vCenter. VASA VP menus will not yet be present.

### Deploying the VASA Provider for clustered Data ONTAP

The VASA Provider for clustered Data ONTAP (VP) must be deployed on an ESXi 5.x server, separate from the ESXi 6.0 beta servers.

1. In the vSphere Web Client inventory trees, right click a datacenter, cluster or specific ESXi server and select "Deploy OVF Template..."
2. Enter a URL or select Local file and browse to find `vasavp-6-0X2.ova` and click Open, then Next.
3. Review details the click Next.
4. Click Accept to accept EULAs then click Next.
5. Give the VP a name and select a folder or datacenter, then click Next.
6. Select a specific resource (cluster or ESXi server) and click Next.
7. Select a datastore and a virtual disk format. Thin is acceptable. You may use a VM Storage Policy if your vSphere 5.x environment is configured for them.

8. Select the correct destination network for the VP. This must be a network accessible to the management connections of all entities in the lab, including your workstation or jumpbox or jump host if you use one, and VSC and vCSA.
9. Fill in the Network Properties and click Next.

**Deploy OVF Template**

**1 Source**

- ✓ 1 a Select source
- ✓ 1 b Review details
- ✓ 1 c Accept EULAs

**2 Destination**

- ✓ 2 a Select name and folder
- ✓ 2 b Select a resource
- ✓ 2 c Select storage
- ✓ 2 d Setup networks
- ✓ 2 e Customize template**
- ✓ 3 Ready to complete

**Customize template**  
Customize the deployment properties of this software solution

**Network Properties** 7 settings

1. Host Name Specify the hostname for the appliance. (Leave blank if DHCP is desired)  
p1vp1

2. IP Address Specify the IP address for the appliance. (Leave blank if DHCP is desired)  
172.16.24.36

3. Netmask Specify the subnet to use on the deployed network. (Leave blank if DHCP is desired)  
255.255.255.0

4. Gateway Specify the gateway on the deployed network. (Leave blank if DHCP is desired)  
172.16.24.1

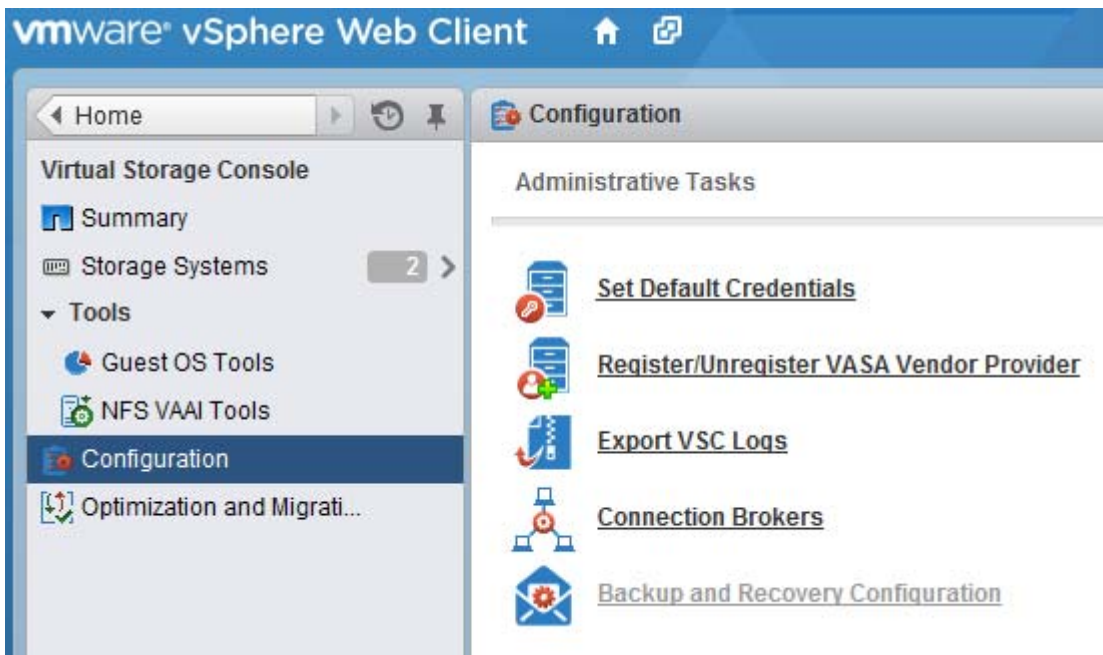
5. Primary DNS Specify the primary DNS server's IP address. (Leave blank if DHCP is desired)  
172.16.24.31

6. Secondary DNS Specify the secondary DNS server's IP address. (optional - Leave blank if DHCP is desired)  
172.16.24.32

7. Search Domains Specify the comma separated list of search domain names to use when resolving hostnames. (Leave blank if DHCP is desired)  
vgibu.eng.netapp.com

Back Next Finish Cancel

10. Review the settings for the VP.
11. Select "Power on after deployment" then click finish.
12. When the deployment completes, open the virtual console to the VP.
13. To install VMware Tools in the VP VM, in the Inventory Trees, click the VM, then in the yellow warning box, click Install VMware Tools.
14. In the VP console, press enter to continue VMware Tools installation.
15. When the installer prompts you, edit the VM settings and ensure the CD-ROM is disconnected and set to Client Device.
16. In the VP console, press enter to reboot.
17. Set passwords for maint and vpserver. Best practice is to use different passwords for these accounts.
18. Wait for the VP to start all processes and Application Status to display "vpserver is running and waiting for vSphere registration".
19. In the vSphere 6.0 beta Web Client, click the Home icon, then Virtual Storage Console → Configuration → Register/Unregister VASA Vendor Provider.



20. Enter the IP Address or hostname of the VP and enter the vpserver password, then click Register.

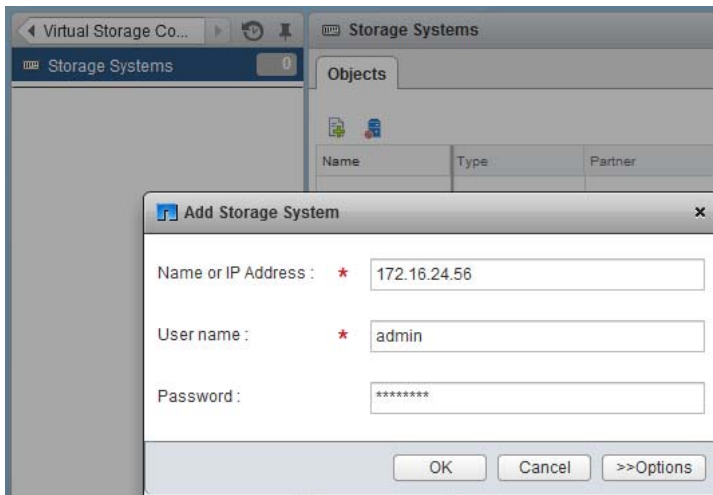
21. After the VP successfully registers, click OK.

22. Log out of the vSphere Web Client then log back in again as [administrator@vsphere.local](mailto:administrator@vsphere.local) in order for the Web Client to load the new menus and workflows.

23. If you get internal error 1063, log out, wait 5-7 minutes, and log back in.

### Add the storage system to VSC

1. From the Web Client home page, click either Virtual Storage Console icon → Storage Systems.
2. Under Objects, click the green plus icon.
3. Enter the cluster management IP address, "admin" for the username and the password you specified for the admin account, then click OK.



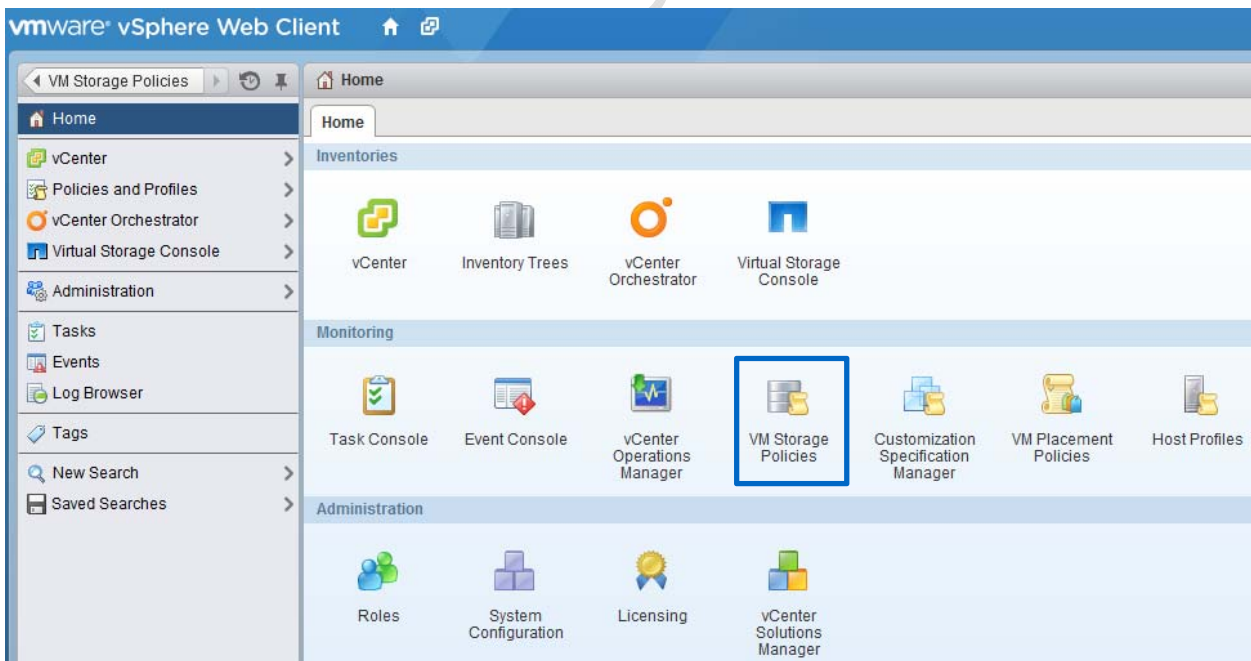
4. Review the allowed privileges then click OK.

### 3 Storage Capability Profiles and VM Storage Policies

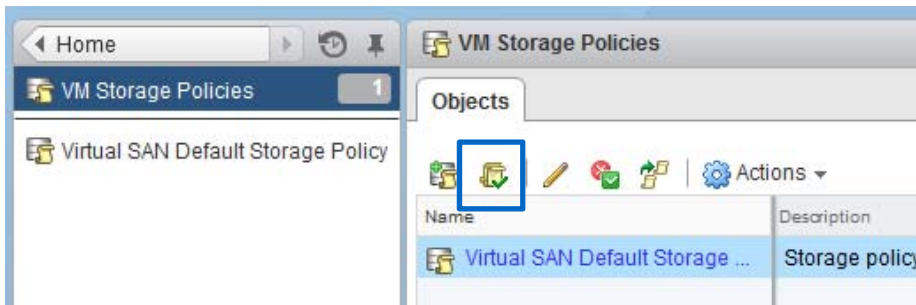
#### 3.1 Enable VM Storage Policies on the ESXi servers or cluster

Before VVols and policy based management of storage can be used, VM Storage Policies must be enabled on the ESXi servers or cluster as follows:

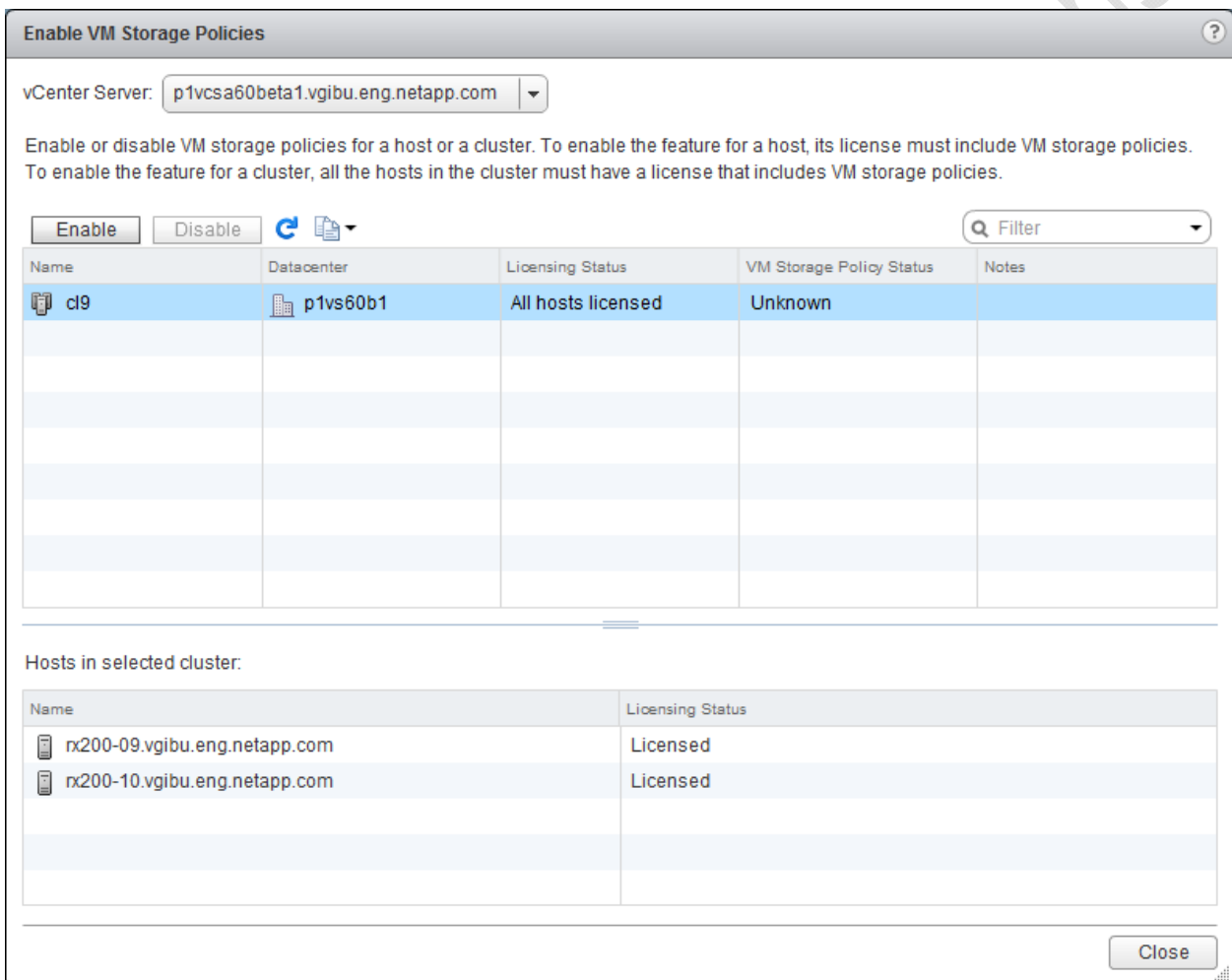
1. From the Web Client home page click VM Storage Policies in the middle Monitoring group.



2. Click the yellow scroll with green checkmark icon.



3. Click the ESXi host or cluster, then click Enable.



4. Repeat step 3 for each ESXi host or cluster.
5. Click Close.

## 3.2 Create SCPs

SCPs can be created in the following ways:

- Default SCPs that are installed with the VP
- From scratch



- By cloning another SCP
- Automatically by reference to existing traditional datastores on NetApp cDOT.

To create a new SCP from scratch:

1. From the Web Client home page, click Virtual Storage Console → VASA Provider for clustered Data ONTAP → Storage Capability Profiles.
2. Click the green plus icon.
3. Give the SCP a name then click Next.
4. For each category of capability, make the appropriate selections then click Next.
  - Yes means the capability is required in this profile.
  - No means the capability is forbidden in this profile.
  - Any means the capability is optional in this profile.
5. Review the summary of capability selections on the last screen then click Finish.

### 3.3 Create a VM Storage Policy mapping the SCP

1. From the Web Client home page, click VM Storage Policies.
2. Click the new VM Storage Policy icon (green plus with a scroll).
3. Give the VM Storage Policy a name then click Next.
4. Click next on the rule set description page.
5. On the rule set page, in the drop-down list next to “Rules based on vendor-specific capabilities” select the NetApp VP.
6. Under the “<Add capability>” drop-down list, select ProfileName.
 

**Note:** The VM administrator can build his own VM Storage Policy from individual capabilities or add capabilities that may have been selected as “Any” in the SCP, but the best practice is to use SCPs as created by the storage administrator.
7. Select an SCP from the list that appears.
8. Click Next.
9. Review the compatible and incompatible storage to ensure that some storage is compliant with the VM Storage Policy.
10. Click Next.
11. Review the Ready to complete screen then click Finish.

## 4 VVol datastores

**Note:** Do not use the built-in vCenter New Datastore wizard to provision NetApp VVol datastores. The NetApp workflow performs all necessary storage-side setup including export policies, initiator groups, LUN mapping, etc. While it is possible to perform these steps manually then use the vCenter New Datastore wizard, it is much more error prone.

### 4.1 Create a VVol datastore

**Note:** Do not use the built-in vSphere New Datastore wizard to create VVol datastores. The built-in wizard does not create FlexVols and other objects on the NetApp cluster.

1. From the Web Client home page, click Inventory Trees.
2. Select an inventory view that shows the level at which you wish to create the VVol datastore (Virtual Datacenter, ESXi cluster or individual ESXi host). The host and clusters tree can be expanded to show all three levels.

3. Right click the object on which you wish to create the VVol datastore then select VASA Provider for clustered Data ONTAP → Provision VVOL Datastore.
  4. Give the VVol datastore a name, select a protocol then click Next.
  5. Select one or more SCPs then click Next.
  6. Select the desired cluster (Storage System) and SVM then click Next.
  7. The wizard allows you to either select existing FlexVols or create new FlexVols, but not both in the same single workflow. If one or more existing FlexVols are selected, the Create FlexVol step will disappear.
    - a. Select one or more FlexVols then click Next. OR
    - b. Click Next to skip the FlexVol Selection step and move to the Provision FlexVol step.
    - c. Click Add
    - d. Fill in the details for a new FlexVol.

**Note:** Only aggregates that the SVM is permitted to use (listed in the SVM aggr-list parameter) will show up in the list.

    - e. Click OK
    - f. Repeat steps c through e to create additional volumes as part of this VVol datastore.
  8. Select the default SCP then click Next.
  9. Review the settings for the VVol datastore then click Finish.
- Note:** No new FlexVols are created until after you click finish.

## 4.2 Add FlexVols to a VVol datastore

In one pass of the Add Storage Wizard, you can either add existing FlexVols or create new FlexVols. To add existing FlexVols to an existing VVol datastore, do the following:

1. From the Web Client home page, click Inventory Trees.
2. Click the datastores tree icon.
3. Right click the VVol datastore → VASA Provider for clustered Data ONTAP → Add Storage to VVOL Datastore.
4. In the Add Storage dialog, select the FlexVols you wish to add to the VVol datastore.
 

**Note:** All the FlexVols in a VVol datastore must be from the same Storage Virtual Machine, therefore the Add Storage dialog only shows FlexVols from the SVM used by the VVol datastore.
5. In the Storage Capability Profile column, use the dropdown list to either create a new profile based on the FlexVol or select one of the existing profiles. The auto-generate feature creates a profile based the storage capabilities, such as disk type, high availability, disaster recovery, performance features, deduplication, and space efficiency, that are associated with that FlexVol.
6. Click Next.
7. Review the Ready to complete screen.
8. Confirm by clicking Finish.

To create new FlexVols and add them to an existing VVol datastore, do the following:

1. From the Web Client home page, click Inventory Trees.
2. Click the datastores tree icon.
3. Right click the VVol datastore → VASA Provider for clustered Data ONTAP → Add Storage to VVOL Datastore.
4. Click Next to skip the Storage Type screen (only used for adding existing FlexVols).



5. Click Add
  6. Fill in the details for a new FlexVol, including selecting an appropriate SCP.
- Note:** Only aggregates that the SVM is permitted to use (listed in the SVM aggr-list parameter) will show up in the list.
7. Click OK
  8. Repeat steps 5 through 7 to create additional volumes as part of this VVol datastore.
  9. Click Next.
  10. Review the Ready to complete screen.
  11. Confirm by clicking Finish.

## 5 Managing VMs

### 5.1 Creating VMs with VVols using VM Storage Policies

To create a VM using VVols:

1. From the Web Client home page, click Inventory Trees → Hosts and Clusters view.
  2. Right click a cluster or host → New Virtual Machine.
  3. Select Create a new virtual machine then click Next.
  4. Give the VM a name and select an inventory location then click Next.
  5. Select a compute resource then click Next.
  6. Select a VM Storage Policy and a compatible datastore then click Next.
  7. Select the appropriate level of host compatibility then click Next.
  8. Select a Guest OS family and version then click Next.
  9. Optionally, customize the VM
    - a. Add additional virtual disks
    - b. For each disk, click the arrowhead to see detailed settings
    - c. Select a VM Storage Policy
    - d. In the location drop down, click Browse.
    - e. Select a compatible datastore then click OK.
- Note:** If you don't see any compatible datastores, you can select a different VM Storage Policy from this screen.
- f. Click OK.
  10. Click Next.
  11. Review settings then click Finish.

### 5.2 Migrating VMS to VVols

VMs can be migrated from traditional datastores to VVols as follows:

1. Right click the VM → Migrate.
2. Click Change storage only then click Next.
3. Select a VM Storage Policy and a compatible datastore then click Next.

4. Review the settings then click Finish.

**Note:** Migration from traditional datastores to VVols does not use VAAI offloads.

## 6 Advanced Features

### 6.1 Deduplication

In order to use an SCP or VM Storage Policy with deduplication, the feature must be enabled on one or more FlexVols. This can be achieved using System Manager or with the following command:

```
cluster::> volume efficiency on -vserver <svm> -volume <volume>
```

For more information on deduplication see the Logical Storage Management Guide [https://library.netapp.com/ecm/ecm\\_download\\_file/ECMP1368017](https://library.netapp.com/ecm/ecm_download_file/ECMP1368017) or Data Compression and Deduplication Deployment and Implementation Guide for Clustered Data ONTAP: <http://media.netapp.com/documents/tr-3966.pdf>.

### 6.2 Compression

In order to use an SCP or VM Storage Policy with compression, the feature must be enabled on one or more FlexVols. This can be achieved using System Manager or with the following command:

```
cluster::> volume efficiency modify -vserver <svm> -volume <volume> -compression true
```

For more information on compression see the Logical Storage Management Guide [https://library.netapp.com/ecm/ecm\\_download\\_file/ECMP1368017](https://library.netapp.com/ecm/ecm_download_file/ECMP1368017) or Data Compression and Deduplication Deployment and Implementation Guide for Clustered Data ONTAP: <http://media.netapp.com/documents/tr-3966.pdf>.

### 6.3 Replication with SnapMirror

This will be documented in a future version of this guide.

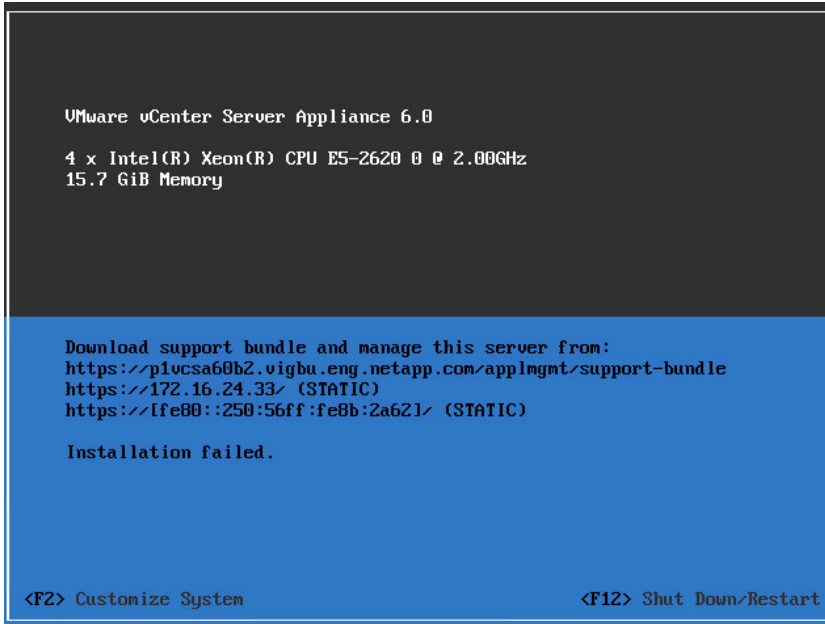
## 7 Troubleshooting

### 7.1 Logs and tools

The Vendor Provider has a set of tools, logs, counters and a web CLI available at the [http://<vp\\_ip>:9080/](http://<vp_ip>:9080/). Log in using the vpserver username and the password you specified when deploying the VP. When asking for support, you may be asked for logs or other information from this page.

## 7.2 vCSA Deployment Issues

“Installation Failed” is displayed on vCSA console after first boot



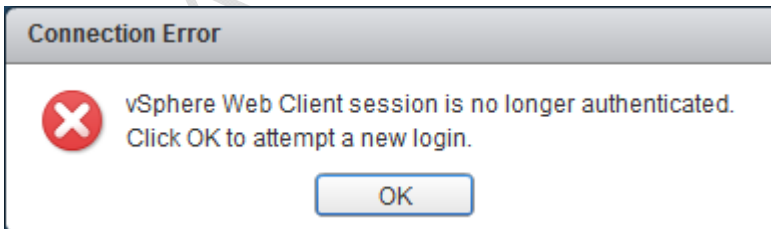
This error can be caused by

- Hostname or FQDN and/or IP address provided in the deployment wizard not matching on both configuration sections or matching the entry on the DNS servers.
- SSO Password not configured in the deployment wizard

**No visible vCenter Servers and/or the message “To get started, either install a vCenter Server system, or obtain access permission to an existing vCenter Server system.”**

Most likely caused by logging in as root or other user which as of beta 2 no longer has the administrators role or group membership by default. Either log in as administrator@vsphere.local for administrative access, or add the other user to the Administrators group in the vCSA server.

**After a session went idle, Web Client gives “Connection Error: vSphere Web Client session is no longer authenticated. Click OK to attempt a new login.” in a loop.**



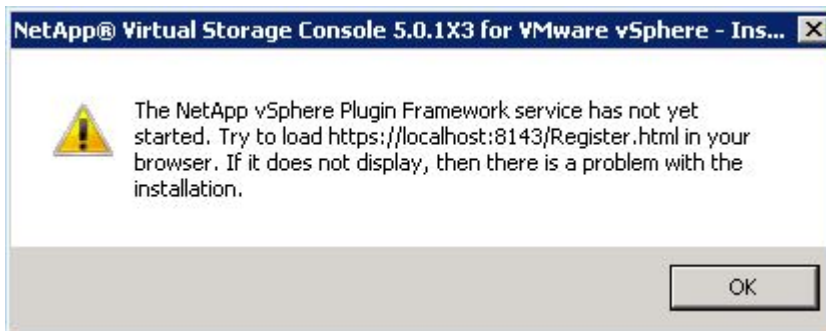
Normally after an idle session, you will simply be prompted to log in again. In some cases, you may need to close the browser (all tabs and windows) and reopen. In extreme cases, you may need to restart the vsphere-client service on the vCSA CLI.

```
plvcsa60beta1:~ # service vsphere-client status
VMware vSphere Web Client is running: PID:32293, Wrapper:STARTED, Java:STARTED
```

```
plvcsa60beta1:~ # service vsphere-client restart
Stopping VMware vSphere Web Client...
Waiting for VMware vSphere Web Client to exit...
Stopped VMware vSphere Web Client.
Starting VMware vSphere Web Client...
Waiting for VMware vSphere Web Client.....
running: PID:10386
plvcsa60beta1:~ # service vsphere-client status
VMware vSphere Web Client is running: PID:10386, Wrapper:STARTED, Java:STARTED
```

### 7.3 VSC issues

NVPF (NetApp VMware Plugin Framework) also known as Virtual Storage Console for VMware vSphere Server service fails to start.



This is caused by VSC setup not properly generating SSL passwords.

1. Log in to the Windows VM running VSC.
2. Open a command prompt
3. CD to the bin directory in the VSC installation directory, usually C:\Program Files\NetApp\Virtual Storage Console\bin.
4. Run the following command:

```
C:\Program Files\NetApp\Virtual Storage Console\bin> vsc.bat ssl setup -generate-passwords
```

5. Start the NVPF service in Windows Services.

**Some datastores have a red exclamation icon and an alert or issue stating “vSphere HA failed to create a configuration vVol for this datastore and so will not be able to protect virtual machines on the datastore until the problem is resolved. Error: (vim.fault.InaccessibleDatastore)”**

If there was an issue with VVol datastores during initial setup, they may not have been accessible to HA for it to create a VVol in which to keep HA information. This error can be cleared by disabling HA then re-enabling it.

#### No submenus under NetApp VSC or VASA context-sensitive menus

This issue may actually affect all submenus, not just VSC/VASA. It may require a restart of the vSphere Web Client service. Log in to the vCSA console or SSH and run the following command:

```
plvcsa60beta1:~ # service vsphere-client restart
Stopping VMware vSphere Web Client...
Waiting for VMware vSphere Web Client to exit...
Waiting for VMware vSphere Web Client to exit...
Stopped VMware vSphere Web Client.
```

```
Starting VMware vSphere Web Client...
Waiting for VMware vSphere Web Client.....
running: PID:31570
```

## **VASA VP context-sensitive menus not showing.**

### **1. Restart the VMware SPS (Storage Profiles Service)**

```
plvcsa60betal:~ # service vmware-sps restart
Stopping VMware vSphere Profile-Driven Storage Service...
Stopped VMware vSphere Profile-Driven Storage Service.
Starting VMware vSphere Profile-Driven Storage Service...
wrapper | An encoding declaration is missing from the top of configuration file,
/usr/lib/vmware-vpx/sps/wrapper/conf/wrapper.conf, trying the system encoding.
wrapper | An encoding declaration is missing from the top of configuration file,
/usr/lib/vmware-vpx/sps/wrapper/conf/wrapper_java_additional.conf, trying the system encoding.
wrapper | Spawning intermediate process...
Waiting for VMware vSphere Profile-Driven Storage Service.....
running: PID:1199
```

2. Log out of the Web Client and log back in again.

3. In some cases, you may need to close and relaunch your web browser.

## **NetApp VP does not show in list of VPs when creating VM Storage Policy**

This should only happen when first setting up the environment, the first time the NetApp VP is registered. Restart the vmware-sps service in vCenter.

```
plvcsa60betal:~ # service vmware-sps restart
Stopping VMware vSphere Profile-Driven Storage Service...
Stopped VMware vSphere Profile-Driven Storage Service.
Starting VMware vSphere Profile-Driven Storage Service...
wrapper | An encoding declaration is missing from the top of configuration file,
/usr/lib/vmware-vpx/sps/wrapper/conf/wrapper.conf, trying the system encoding.
wrapper | An encoding declaration is missing from the top of configuration file,
/usr/lib/vmware-vpx/sps/wrapper/conf/wrapper_java_additional.conf, trying the system encoding.
wrapper | Spawning intermediate process...
Waiting for VMware vSphere Profile-Driven Storage Service.....
running: PID:10624
```

## **Error message “Unable to connect to Virtual Storage Console server.”**

This error can be caused by several issues on the VM running VSC such as

- Windows Firewall too restrictive on the VSC VM
- Networking problem on the VSC VM
- Windows was not activated on the server or VM running VSC.

## **How to unregister VASA VP when VSC thinks it is registered but menus don't show up**

1. Open the vSphere Managed Object Browser by pointing your web browser to [https://your\\_vc\\_server/mob/?moid=ExtensionManager](https://your_vc_server/mob/?moid=ExtensionManager).

2. Click (more...) to see all registered extensions.

3. Look for

extensionList["com.netapp.vasa.webclient"]      Extension

extensionList["com.netapp.vasa.vvol.webclient"]      Extension

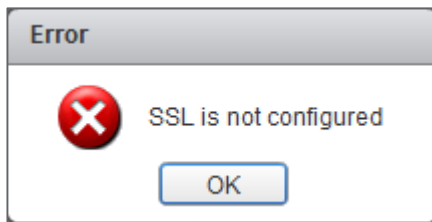
4. Click UnregisterExtension

5. Enter com.netapp.vasa.vvol.webclient

6. Click Invoke Method.

7. Repeat steps 4 through 6 for the com.netapp.vasa.webclient extension.  
**Note:** Later versions of the VP only have one extension.
8. You can now reregister the VP using VSC → Configuration → Register/Unregister VASA Vendor Provider.
9. On the vCenter server, restart vmware-sps and vsphere-client services.
10. Log out of vSphere Web Client and log back in again.

### Adding a storage system fails with “SSL is not configured”



First, test without using SSL by clicking the Options>> button on the Add Storage System dialog then unchecking Use SSL.

Usually cDOT SSL is configured as necessary automatically during setup. However, to verify if any settings have changed, refer to the “Managing SSL” section of the Clustered Data ONTAP® 8.2 System Administration Guide for Cluster Administrators.

This error will also be seen when there is an IP address conflict with the cluster management LIF.

### New SVM or volume not showing up in VSC menus

New storage objects need to be discovered. Go to VSC → Storage Systems and click the blue storage icon to Update All.

### <ESXi server list> are incompatible host.

This may be caused by an actual compatibility issue, or if the server(s) are members of any vSphere distributed switch (vDS). For VP 6.0X2 and VSC 5.0.1X7, vDS are not supported. You must use vSphere standard switches on each ESXi server.

### VVol datastore provisioning fails, but selected FlexVol shows as used

In some cases, the workflow may not complete. The datastore may actually be created and the FlexVol(s) consumed. You may be able to connect the VVol datastore to ESXi using the vSphere New Datastore wizard.

1. Right click the host, cluster or datacenter as originally selected when creating the failed VVol datastore, then Storage → New Datastore...
2. Click Next
3. Select VVol, then click Next.
4. The failed VVol datastore / container should appear in the list on the next screen. Change the datastore name as appropriate and select the container.
5. Click Next
6. Select hosts then click Next.
7. Click Finish.

The VVol datastore should now be mounted, and visible in the datastores inventory tree.

## 8 FAQ

### Do I have to create a SVM (Vserver)?

Yes. Creating an SVM is not automated as part of the VVols workflows.

### Do I have to create volumes?

With VP 6.0X2 and VSC 5.0.1X7 (the versions provided for use with vSphere 6.0 RC), the Provision VVol Datastore wizard allows you to either use existing FlexVols or create new ones. With VSC 5.0.1X3 and VP 6.0X1 (intended for use with vSphere 6.0 Beta 2, and should no longer be used) the VVol workflow could only consume existing FlexVols.

### Do I have to create LUNs for Vvols?

No. Creating a VM or component of a VM that needs a VVol creates a VVol LUN automatically for block protocols.

### Can vCenter, VSC or the VP manage replication relationships (SnapMirror)?

There is no way to invoke NetApp replication from vCenter. vCenter relies on storage management tools to create and manage replication relationships. With NetApp, the replication technology is SnapMirror. It can be managed by OnCommand® System Manager, OnCommand Workflow Automation, CLI, API, and PowerShell. However, SnapMirror relationships are what is referenced by the replication capability.

## References

This report references the following documents and resources:

- Virtual Volumes Technical FAQ <https://communities.vmware.com/docs/DOC-27367> (Requires vSphere 6 beta2 access)
- NetApp® Readme for Beta Release VASA Provider for clustered Data ONTAP  
[http://mysupport.netapp.com/NOW/download/software/beta/beta\\_vasa\\_cd/6.0X2/readme\\_VP-RC.pdf](http://mysupport.netapp.com/NOW/download/software/beta/beta_vasa_cd/6.0X2/readme_VP-RC.pdf) fs
- Using VMware VVOLs with Clustered Data ONTAP Storage  
[http://mysupport.netapp.com/NOW/download/software/beta/beta\\_vasa\\_cd/6.0X2/VVOLS\\_QuickStart\\_RC.pdf](http://mysupport.netapp.com/NOW/download/software/beta/beta_vasa_cd/6.0X2/VVOLS_QuickStart_RC.pdf)
- [http://mysupport.netapp.com/NOW/download/software/beta/beta\\_vasa\\_cd/6.0X2/](http://mysupport.netapp.com/NOW/download/software/beta/beta_vasa_cd/6.0X2/)
- Simulate ONTAP 8.2 Installation and Setup Guide
- VSC 5.0 documentation  
<http://mysupport.netapp.com/documentation/docweb/index.html?productID=61789&language=en-US>
- 

## Version History

Version	Date	Document Version History
Version 1.0	Sep 2014	Initial version

Version	Date	Document Version History
Version 1.04	Nov 2014	Updated for vSphere 6.0 RC, NetApp VASA VP 6.0X2 and VSC 5.0.1X7.
1.05	Dec 2014	Added time server note. Corrected text that FlexVols can now be created as part of new datastore wizard

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Refer to the [Interoperability Matrix Tool \(IMT\)](#) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

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